



08/08/97

Practitioner's Docket No. \_\_\_\_\_

**PATENT**A/150  
fee**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

**NEW APPLICATION TRANSMITTAL**

Transmitted herewith for filing is the patent application of

Inventor(s):

Richard L. Eby and Urs F. Nager, Jr.

**WARNING:** Patent must be applied for in the name(s) of all of the actual inventor(s). 37 CFR 1.41(a) and 1.53(b).

For (title):

ELECTRICAL CONNECTOR WITH PLANAR CONTACT  
ENGAGING SURFACE

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**CERTIFICATION UNDER 37 C.F.R. 1.10\***  
(Express Mail label number is mandatory.)  
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date August 8, 1997, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EI003633599, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Richard J. Birch

(type or print name of person mailing paper)

Signature of person mailing paper

**WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

**\*WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will **not** be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(Application Transmittal [4-1]—page 1 of 9)

## 1. Type of Application

This new application is for a(n)

(check one applicable item below)

☒ Original (nonprovisional)

☐ Design

☐ Plant

**WARNING:** Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

**WARNING:** Do not use this transmittal for the filing of a provisional application.

**NOTE:** If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

☐ Divisional.

☐ Continuation.

☐ Continuation-in-part (C-I-P).

## 2. Benefit of Prior U.S. Application(s) (35 U.S.C. 119(e), 120, or 121)

**NOTE:** If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**WARNING:** If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

**WARNING:** When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

## 3. Papers Enclosed That Are Required for Filing Date under 37 C.F.R. 1.53(b) (Regular) or 37 C.F.R. 1.153 (Design) Application

5 Pages of specification

7 Pages of claims

1 Pages of Abstract

9 Sheets of drawing

☐ formal

☒ informal

**WARNING:** *DO NOT* submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. Comments on proposed new 37 CFR 1.84. Notice of March 9, 1988 (1990 O.G. 57-62).

**NOTE:** "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page." 37 C.F.R. 1.84(c)).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. 1.84(b).

**4. Additional papers enclosed**

- ☐ Preliminary Amendment  
☐ Information Disclosure Statement (37 C.F.R. 1.98)  
☐ Form PTO-1449 (PTO/SB/08A and 08B)  
☐ Citations  
☐ Declaration of Biological Deposit  
☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.  
☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative  
☐ Special Comments  
☐ Other

**5. Declaration or oath**

- ☐ Enclosed  
Executed by

(check all applicable boxes)

- ☐ inventor(s).  
☐ legal representative of inventor(s).  
37 CFR 1.42 or 1.43.  
☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.  
☐ This is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

☒ Not Enclosed.

**WARNING:** *Where the filing is a completion in the U.S. of an International Application, but where a declaration is not available, or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.*

- ☐ Application is made by a person authorized under 37 C.F.R. 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently).

NOTE: It is important that all the correct inventor(s) are named for filing under 37 CFR 1.41(c) and 1.53(b).

- ☐ Showing that the filing is authorized.  
(not required unless called into question. 37 CFR 1.41(d))

## 6. Inventorship Statement

**WARNING:** If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

- ☒ The same.

or

- ☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,  
☐ is submitted.  
☐ will be submitted.

## 7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. A verified English translation of the non-English language application and the processing fee of \$130.00 required by 37 CFR 1.17(k) is required to be filed with the application, or within such time as may be set by the Office. 37 CFR 1.52(d).

NOTE: A non-English oath or declaration in the form provided or approved by the PTO need not be translated. 37 CFR 1.69(b).

- ☒ English  
☐ Non-English  
☐ The attached translation is a verified translation. 37 C.F.R. 1.52(d).

## 8. Assignment

- ☒ An assignment of the invention to High Voltage Engineering Corporation

- ☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

- ☒ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

**WARNING:** A newly executed "CERTIFICATE UNDER 37 CFR 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

**9. Certified Copy**

Certified copy(ies) of application(s)

Country	Appln. no.	Filed
Country	Appln. no.	Filed
Country	Appln. no.	Filed

from which priority is claimed

☐ is (are) attached.☐ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 CFR 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

**10. Fee Calculation (37 C.F.R. 1.16)**A. ☒ Regular application

CLAIMS AS FILED					
Number filed		Number Extra		Rate	Basic Fee 37 C.F.R. 1.16(a) \$770.00
Total 22					
Claims (37 CFR 1.16(c))	- 20 =	2	×	\$ 22.00	44.00
Independent 6					
Claims (37 CFR 1.16(b))	- 3 =	3	×	\$ 80.00	240.00
Multiple dependent claim(s), if any (37 CFR 1.16(d))			+	\$260.00	0

☐ Amendment cancelling extra claims is enclosed.☐ Amendment deleting multiple-dependencies is enclosed.☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 CFR 1.16(d).

Filing Fee Calculation

\$ 1,054.00

- B. ☐ Design application  
(\$320.00—37 CFR 1.16(f))

Filing Fee Calculation

\$ \_\_\_\_\_

- C. ☐ Plant application  
(\$530.00—37 CFR 1.16(g))

Filing fee calculation

\$ \_\_\_\_\_

**11. Small Entity Statement(s)**

- ☐ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is (are) attached.

**WARNING:** "Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. A nonprovisional application claiming benefit under 35 U.S.C. 119(e), 120, 121 or 365(c) of a prior application may rely on a verified statement filed in the prior application if the nonprovisional application includes a reference to a verified statement in the prior application or includes a copy of the verified statement filed in the prior application if status as a small entity is still proper and desired." 37 C.F.R. § 1.28(a).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application

\_\_\_\_\_ / \_\_\_\_\_, filed on \_\_\_\_\_, from which benefit is being claimed for this application under:

- 35 U.S.C. ☐ 119(e),  
☐ 120,  
☐ 121,  
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the verified statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ \_\_\_\_\_

**NOTE:** Any excess of the full fee paid will be refunded if a verified statement and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 CFR 1.28(a).

**12. Request for International-Type Search (37 C.F.R. 1.104(d))**

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

**13. Fee Payment Being Made at This Time**

☒ Not Enclosed

☒ No filing fee is to be paid at this time.

*(This and the surcharge required by 37 C.F.R. 1.16(e) can be paid subsequently.)*

☐ Enclosed

☐ Basic filing fee \$ \_\_\_\_\_

☐ Recording assignment  
(\$40.00; 37 C.F.R. 1.21(h))  
(See attached "COVER SHEET FOR  
ASSIGNMENT ACCOMPANYING NEW  
APPLICATION".) \$ \_\_\_\_\_

☐ Petition fee for filing by other than all the  
inventors or person on behalf of the inventor  
where inventor refused to sign or cannot be  
reached  
(\$130.00; 37 C.F.R. 1.47 and 1.17(h)) \$ \_\_\_\_\_

☐ For processing an application with a  
specification in  
a non-English language  
(\$130.00; 37 C.F.R. 1.52(d) and 1.17(k)) \$ \_\_\_\_\_

☐ Processing and retention fee  
(\$130.00; 37 C.F.R. 1.53(d) and 1.21(l)) \$ \_\_\_\_\_

☐ Fee for international-type search report  
(\$40.00; 37 C.F.R. 1.21(e)) \$ \_\_\_\_\_

*NOTE: 37 CFR 1.21(l) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 CFR 1.53(d) and this, as well as the changes to 37 CFR 1.53 and 1.78, indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(l) must be paid, within 1 year from notification under § 53(d).*

Total fees enclosed \$ \_\_\_\_\_

**14. Method of Payment of Fees**

☐ Check in the amount of \$ \_\_\_\_\_

☐ Charge Account No. \_\_\_\_\_ in the amount of  
\$ \_\_\_\_\_

A duplicate of this transmittal is attached.

*NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 CFR 1.22(b).*

## 15. Authorization to Charge Additional Fees

**WARNING:** If no fees are to be paid on filing, the following items should not be completed.

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. \_\_\_\_\_:

- ☐ 37 C.F.R. 1.16(a), (f) or (g) (filing fees)  
☐ 37 C.F.R. 1.16(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 CFR 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

- ☐ 37 C.F.R. 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)  
☐ 37 C.F.R. 1.17 (application processing fees)

**WARNING:** While 37 CFR 1.17(a), (b), (c) and (d) deal with extensions of time under § 1.136(a), this authorization should be made only with the knowledge that: "Submission of the appropriate extension fee under 37 C.F.R. 1.136(a) is to no avail unless a request or petition for extension is filed." (Emphasis added). Notice of November 5, 1985 (1060 O.G. 27).

- ☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 CFR 1.311(b).

**NOTE:** 37 CFR 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . issue fee." From the wording of 37 CFR 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

## 16. Instructions as to Overpayment

- ☐ Credit Account No. \_\_\_\_\_  
☐ Refund

  
SIGNATURE OF PRACTITIONER

Reg. No. 20,895

Richard J. Birch

(type or print name of attorney)

Tel. No. ( ) 617-237-1819

8 River Glen Road

P.O. Address

Customer No.

Wellesley, MA 02181



☐ **Incorporation by reference of added pages**

*(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)*

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added \_\_\_\_\_

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added \_\_\_\_\_

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added \_\_\_\_\_

☒ **Statement Where No Further Pages Added**

*(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)*

- ☒ This transmittal ends with this page.

APPLICATION

OF

RICHARD L. EBY

AND

URS F. NAGER, JR.

FOR

ELECTRICAL CONNECTOR WITH PLANAR  
CONTACT ENGAGING SURFACE

468907-2480680

## BACKGROUND OF THE INVENTION

The present invention relates to electrical connectors in general and, more particularly, to a genderless electrical contact having a planar electrical contact engaging surface.

Genderless electrical connectors are well known in the art. Representative examples of such connectors include the connectors manufactured and sold by the Anderson Power Product Division of High Voltage Engineering Corporation under the registered trademarks SB® and PowerPole®. The construction of the SB® electrical connector is shown in U.S. Patent No. 3,909,099 issued September 30, 1975 to Edward D. Winkler for "Electrical Connector With Movably Mounted Cable Clamp". The subject matter of U.S. Patent No. 3,909,099 is incorporated herein in its entirety by reference. The construction of the PowerPole® electrical connectors is shown in U.S. Patent 3,259,870 issued July 5, 1966 to Edward D. Winkler for "Electrical Connector". The subject matter of U.S. Patent No. 3,259,870 is incorporated herein in its entirety by reference.

The Winkler electrical connectors employ a rigid terminal member or contact that is attached to a wire lead by soldering or crimping. The contact itself is mounted within a housing under a spring load. The contact normally has an arcuate distal end so that it will engage with a corresponding electrical contact with the arcuate ends overriding each other to a detent position.

This general type of genderless electrical contact also has been manufactured and sold with a planar distal surface and an arcuate distal end i.e., the SB®-50 and PowerPole®-75 electrical connectors. However, these connectors were not designed to maintain, nor did they maintain, the positional integrity of the electrical contact within the housing. The electrical contact was free to move within the housing so that initial electrical surface contact with another electrical contact varied in terms of where the initial contact actually occurred on the contact surfaces. This was not a problem because the connector was UL and CSA rated for disconnect use

only.

With the advent of uninterruptable power supplies, the need has arisen for "hot swappable" power supplied for rechargeable batteries. The instantaneous "inrush" electrical current flow upon connection to a UPS circuit having capacitive/reactive components is well above the steady state current load after the component(s) have been charged. At this current level, arcing of the electrical connector contacts creates a significant problem with welding of the electrical contacts a not infrequent occurrence.

It is, accordingly, a general object of the invention to provide an improved genderless electrical connector for connect disconnect use under load.

It is a specific object of the invention to provide genderless electrical contacts that minimize contact "bounce".

It is another object of the invention to provide an electrical connector having a genderless electrical contact with a planar contact engaging surface that is positionally maintained to provide repeatable mating with the planar contact engaging surface of a corresponding electrical connector.

#### BRIEF SUMMARY OF THE INVENTION

A genderless electrical contact has a planar electrical contact engaging surface. The plane of the surface intersects the longitudinal axis of the contact at a predetermined angle in the range of 8° to 39° inclusive. The electrical contact is mounted within a housing and is positionally maintained therein so that the contact will engage with another planar electrical contact engaging surface so that the two planar surfaces are substantially parallel to each other at the moment of physical and electrical contact.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagrammatic view in section of two matable genderless electrical connectors with planar electrical contacting surfaces on the connector contacts;

Figure 2 is a wire frame drawing of the electrical contact;

Figure 3 is a plan view of the electrical contact;

Figure 4 is a graph showing the maximum rate of closure vs connection angle for the planar surface electrical contacts;

Figures 5a, 5b and 5c are, respectively, side, plan and end views of an electrical contact for buss use;

Figures 6a, 6b and 6c are, respectively, side, plan and end views of an electrical contact for printed circuit board use;

Figures 7a, 7b and 7c are, respectively, side, plan and end views of an electrical connector and electrical contacts for buss use with Figures 7a and 7b shown in partial section;

Figures 8a, 8b and 8c are, respectively, side, plan and end views of an electrical connector and vertical electrical contacts with Figures 8a and 8b shown in partial section;

Figures 9a, 9b and 9c are, respectively, side, plan and end views of an electrical connector and electrical contacts for use with printed circuit boards and with Figures 9a and 9b shown in partial section;

Figures 10a, 10b and 10c are, respectively, side, plan and end views of an electrical connector and electrical contacts with Figures 10a and 10b shown in partial section; and,

Figure 11 is a plan view of a contact strip showing three of many contacts joined together by a web between contacts.

#### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning now to the drawings, and particularly to Figures 1-3, there is shown an electrical connector 10 of the type described in detail in the aforementioned U.S. Patent 3,259,870. Electrical connector 10 has a housing 12 within which is mounted a genderless electrical contact 14 having a distal end 16, a proximal end 18 and a longitudinal axis 20. Upstanding tabs 22 are formed in the connector and provide a mechanical stop with wall section 24 of housing 12 to prevent movement of the contact to the left as viewed in Figure 1. A leaf spring 26 is staked to the housing 12 and provides a spring loading to electrical contact 12 as it bears against projections 28 formed on the underside of the distal end 16.

The distal end 16 has a planar electrical contact engaging surface 30, the plane of which intersects the longitudinal axis 20 at a predetermined angle within the range of 8 to 39 degrees inclusive. The angle of intersection is determined by the rate of closure of connector 10 with respect to a corresponding connector 10a. The graph of Figure 4 illustrates the maximum rate of closure versus the connection angle i.e., the intersection of the planar surface plan with the longitudinal axis 20.

It will be appreciated that the combination of the staked leaf spring 26 and the mechanical stop formed by tabs 22 and housing wall 22 accurately position and maintain the position of the electrical contact 14 within housing 12. Movement of the electrical connector along longitudinal axis 20 is prevented by this combination.

The angular position of the plane of the planar electrical contact engaging surface with respect to the longitudinal axis is maintained by three contact points 32, 34 and 36. Lateral movement is constrained by the width of the distal end 16.

By accurately positioning and maintaining the position of the planar electrical contact engaging surface 30, the surface will be substantially parallel to the planar surface 30a of the other electrical connector 10a at the moment of physical and electrical contact. The degree of departure from parallelism should not exceed 3 degrees with respect to the longitudinal axis 20. With this configuration, both contact bounce and arcing are minimized.

Further engagement of the two electrical connectors 10 and 10a positions arcuate contact portions 38 and 38a in respective detents 40 and 40a under spring loaders provided by leaf springs 26 and 26a in overlapped arrangement (see, for example, Figure 4 of U.S. Patent No. 3,259,870).

The electrical contacts 14 and 14a incorporate two upstanding tabs 42 for connection to a wire or wires (not shown). Other forms of wire or circuit connections are depicted in Figures 5 through 10.

Figures 5a-5c and Figures 6a-6c each show in side, plan and end views variations on the connection to a wire(s) or circuit. Figures 5a-5c

illustrate a buss type connection with a fastener aperture 44 while Figures 6a-6c depict printed circuit board connections 46. In each drawing, housing 12 is shown by the dashed lines.

Figures 7a-7c through 10a-10c illustrate in partial section an electrical connector of the type shown in U.S. Patent No. 3,909,099 and sold under the registered trademark SB®. While the housing 48 is different from the housing 12, the electrical contacts 14 have the previously mentioned planar electrical contact engaging surfaces 30 and are positionally maintained within the housing by tabs 22 and a corresponding leaf spring (not shown).

Figures 7a-7b depict the electrical contact with a buss connection with aperture 50 provided for a fastener. Figures 8a-8c illustrate another configuration of the electrical connection using vertical contacts 52.

Figures 9a-9c and Figures 10a-10c show printed circuit board contacts 54 in two different arrangements.

Figure 11 shows in plan view a strip 56 of the contacts 14 joined together at their intermediate portions 17 by a web 58. In this configuration the contacts are suitable for machine crimping assembly to wires (not shown).

Having described in detail a preferred embodiment of the invention, it will now be apparent that numerous modifications can be made without departing from the scope of the following claims.

What I claim is:

1. An electrical connector comprising:  
a housing; and,  
a genderless electrical contact mounted within said housing, said genderless electrical contact having a longitudinal axis, a proximal end and distal end, said distal end having a planar electrical contact engaging surface with the plane thereof intersecting the longitudinal axis at a predetermined angle, said planar electrical contact engaging surface being positionally maintained within said housing to permit repeatable electrical engagement with a planar electrical contact engaging surface of a corresponding genderless electrical contact.

2. The electrical connector of claim 1 wherein the plane of said planar electrical contact engaging surface intersects the longitudinal axis at an predetermined angle in the range of 8 to 39 degrees inclusive.

3. An electrical connector comprising:  
a housing; and,  
a genderless electrical contact mounted within said housing, said genderless electrical contact having a longitudinal axis, a proximal end and distal end, said distal end having a planar initial electrical contact engaging surface portion with the plane thereof intersecting the longitudinal axis at a predetermined angle and an arcuate final electrical contact engaging surface portion, said initial and final electrical contact engaging surface portions being positionally maintained within said housing to permit repeatable electrical engagement with planar initial and arcuate final electrical contact engaging surface portions, respectively, of a corresponding genderless electrical contact.

4. The electrical connector of claim 3 wherein the plane of said planar initial electrical contact engaging surface intersects the longitudinal axis at an predetermined angle in the range of 8 to 39 degrees inclusive.



1 5. The electrical connector of claim 3 further comprising:  
2 a spring element mounted within said housing and bearing against said  
3 genderless electrical contact to spring load the genderless electrical  
4 contact.

1 6. The electrical connector of claim 3 wherein said genderless electrical  
2 contact includes an electrical conductor engaging element.

1 7. The electrical connector of claim 3 wherein said housing also is  
2 genderless so that the electrical connector can mate with another electrical  
3 connector having a corresponding genderless housing and a genderless  
4 electrical contact.

2025-09-24 14:00:00

8. An electrical connector assembly comprising:

a first electrical connector comprising:

a housing; and,

a genderless electrical contact mounted within said housing, said genderless electrical contact having a longitudinal axis, a proximal end and distal end, said distal end having a planar electrical contact engaging surface portion with the plane thereof intersecting the longitudinal axis at a predetermined angle;

a second electrical connector comprising:

a housing; and,

a genderless electrical contact mounted within said housing, said genderless electrical contact having a longitudinal axis, a proximal end and distal end, said distal end having a planar electrical contact engaging surface portion with the plane thereof intersecting the longitudinal axis at a predetermined angle;

said first and second electrical connector genderless electrical contacts being electrically engagable with each other with the planes of the planar electrical contact engaging surface portions intersecting the longitudinal axes at substantially the same predetermined angle and with the planar electrical contact engaging surface portions being positionally maintained within their respective housings so that said planar electrical contact engaging surface portions are substantially parallel at the moment of their electrical engagement thereby permitting repeatable electrical engagement with minimal contact bounce thereof.

1 9. An electrical connector assembly comprising:

2 a first electrical connector comprising:

3 a housing; and,

4 a genderless electrical contact mounted within said  
5 housing, said genderless electrical contact having a  
6 longitudinal axis, a proximal end and distal end, said  
7 distal end having a planar initial electrical contact  
8 engaging surface portion with the plane thereof  
9 intersecting the longitudinal axis at a predetermined  
10 angle and an arcuate final electrical contact engaging  
11 surface portion;

12 a second electrical connector comprising:

13 a housing; and,

14 a genderless electrical contact mounted within said  
15 housing, said genderless electrical contact having a  
16 longitudinal axis, a proximal end and distal end, said  
17 distal end having a planar initial electrical contact  
18 engaging surface portion with the plane thereof  
19 intersecting the longitudinal axis at a predetermined  
20 angle and an arcuate final electrical contact engaging  
21 surface portion;

22 said first and second electrical connector genderless electrical contacts  
23 being electrically engagable with the planes of the planar initial electrical  
24 contact engaging surface portions intersecting the longitudinal axes at  
25 substantially the same predetermined angle and with the planar initial  
26 electrical contact engaging surface portions being positionally maintained  
27 within their respective housings so that said planar initial electrical  
28 contact engaging surface portions are substantially parallel at the moment of  
29 their electrical engagement thereby permitting repeatable electrical  
30 engagement with minimal contact bounce thereof.

10. The electrical connector assembly of claim 9 wherein the magnitude of the predetermined angle of intersection of the planes with the longitudinal axes is established as a function of a predetermined rate of closure of the planar initial electrical contact engaging surface portions during electrical engagement thereof.

11. The electrical connector assembly of claim 10 wherein the magnitude of the predetermined angle of intersection of the planes with the longitudinal axes decreases as the rate of closure of the planar initial electrical contact engaging surface portion increases.

12. The electrical connector assembly of claim 11 wherein the magnitude of the predetermined angle of intersection of the planes with the longitudinal axes is established in accordance with the following table:

<u>Predetermined angle (degrees)</u>	<u>Rate of Closure (meters/sec)</u>
39	.1 to 1
30	.1 to 3
25	.1 to 5
13.5	.1 to 10
8	.1 to 15

1 13. An electrical contact assembly of a plurality of genderless electrical  
2 contacts comprising:  
3 an integrally formed, longitudinally extending genderless electrical  
4 contact having:  
5 having a longitudinal axis, a proximal end, an intermediate  
6 portion and distal end, said distal end having a planar electrical  
7 contact engaging surface portion with the plane thereof  
8 intersecting the longitudinal axis at a predetermined angle;  
9 and,  
10 web means for connecting at least two of said plurality of  
11 electrical contacts together in spaced apart relation.

1 14. The electrical contact assembly of claim 13 wherein said web means  
2 connects said at least two genderless electrical contacts together at the  
3 intermediate portions thereof.

1 15. The electrical contact assembly of claim 13 wherein said web means  
2 is integrally formed with said at least two genderless electrical connectors.

1 16. The electrical contact assembly of claim 13 wherein the plane of said  
2 planar electrical contact engaging surface intersects the longitudinal axis at  
3 a predetermined angle in the range of 8 to 39 degrees inclusive.

1 17. An electrical contact assembly of a plurality of genderless electrical  
2 contacts comprising:

3 an integrally formed, longitudinally extending genderless electrical  
4 contact having:

5 a longitudinal axis, a proximal end, an intermediate portion and  
6 distal end, said distal end having a planar initial electrical  
7 contact engaging surface portion with the plane thereof

8 intersecting the longitudinal axis at a predetermined angle and an

9 arcuate final electrical contact engaging surface portion;

10 and,

11 web means for connecting at least two of said plurality of

12 electrical contacts together in spaced apart relation.

1 18. The electrical contact assembly of claim 17 wherein said web means  
2 connects said at least two genderless electrical contacts together at the  
3 intermediate portions thereof.

1 19. The electrical contact assembly of claim 17 wherein said web means  
2 is integrally formed with said at least two genderless electrical connectors.

1 20. The electrical contact assembly of claim 17 wherein the plane of said  
2 planar initial electrical contact engaging surface portion intersects the  
3 longitudinal axis at a predetermined angle in the range of 8 to 39 degrees  
4 inclusive.

1 21. The electrical connector of claim 1 wherein the distal end and the planar  
2 electrical contacting surface are coterminous.

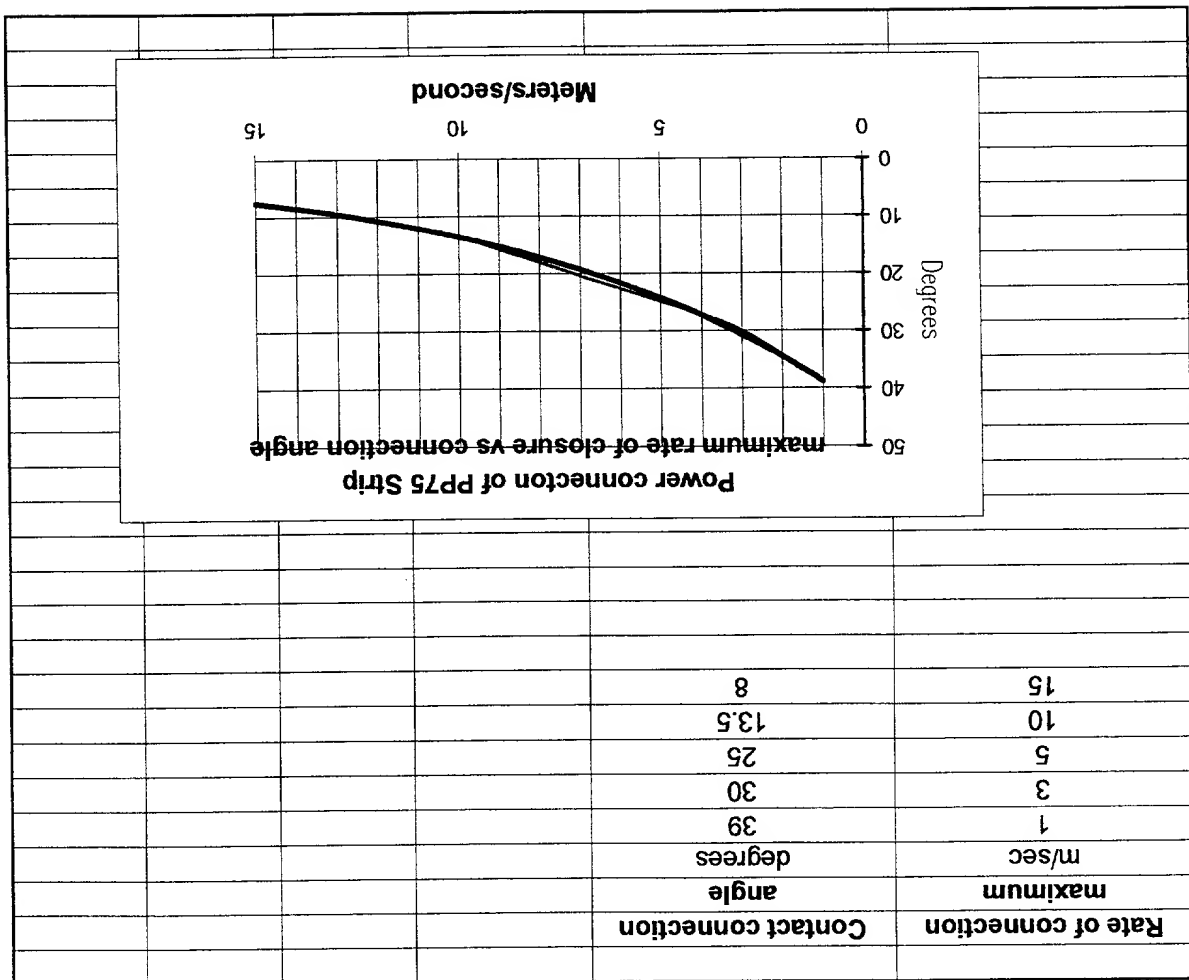
1 22. The electrical connector of claim 3 wherein the distal end and the planar  
2 initial electrical contact engaging surface are coterminous.

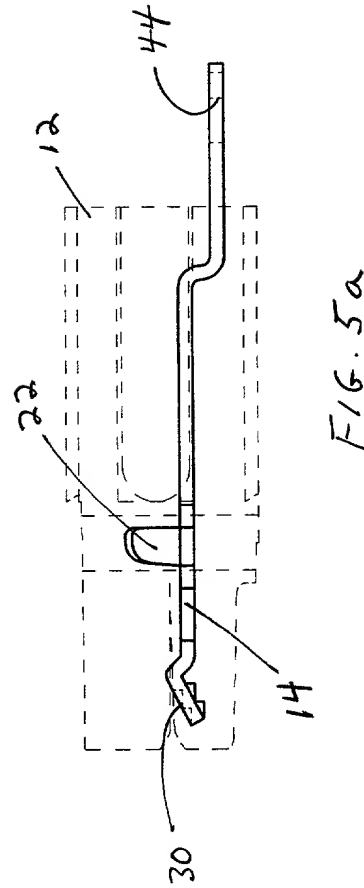
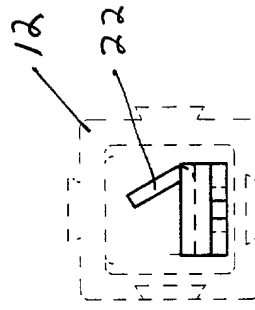
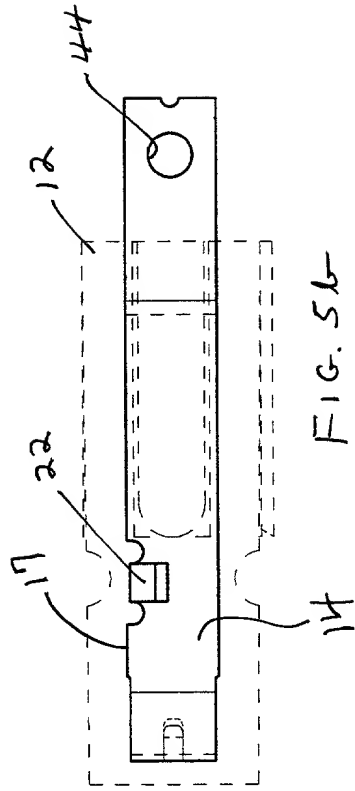






Fig. 4





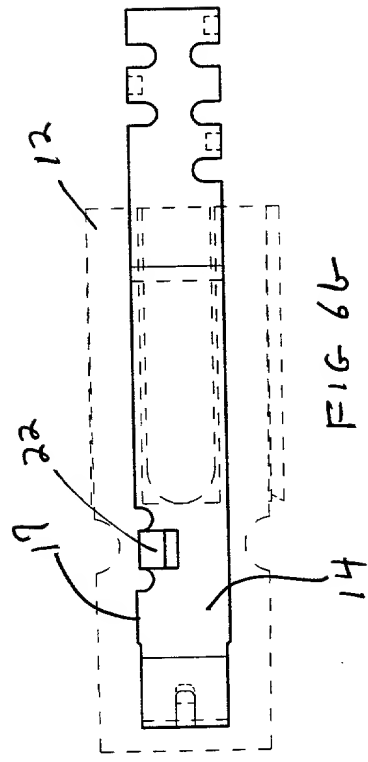


FIG. 6b

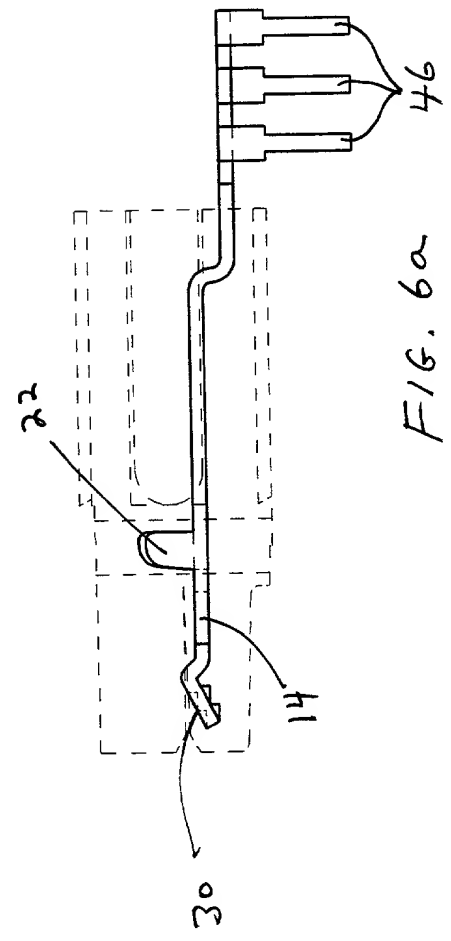


FIG. 6a

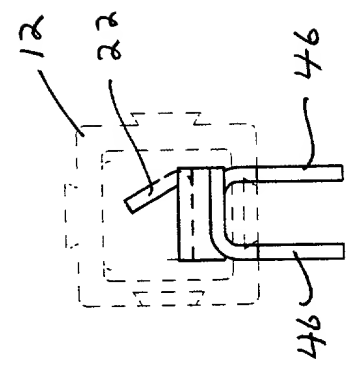
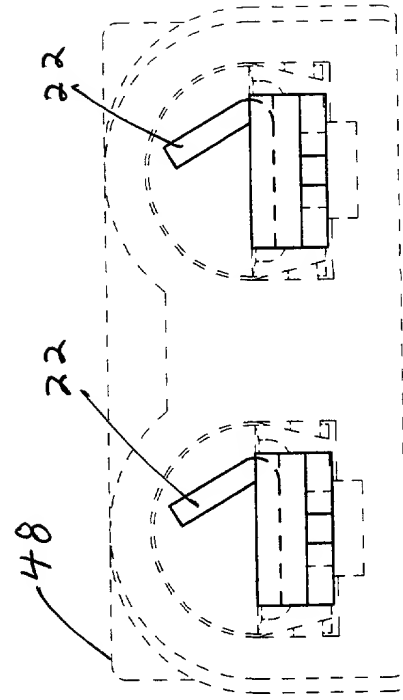
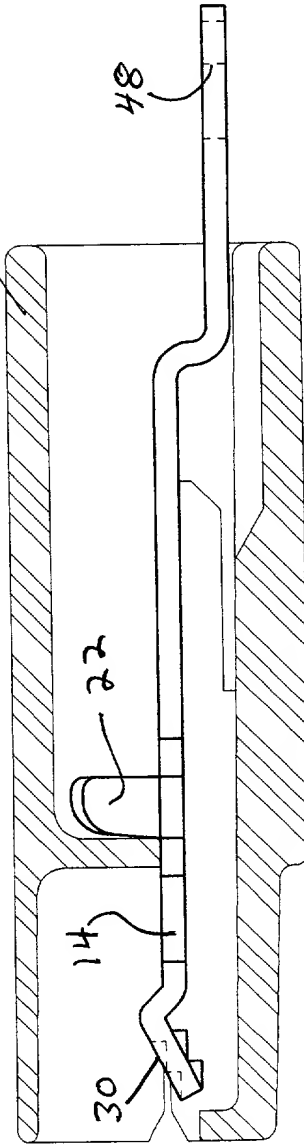
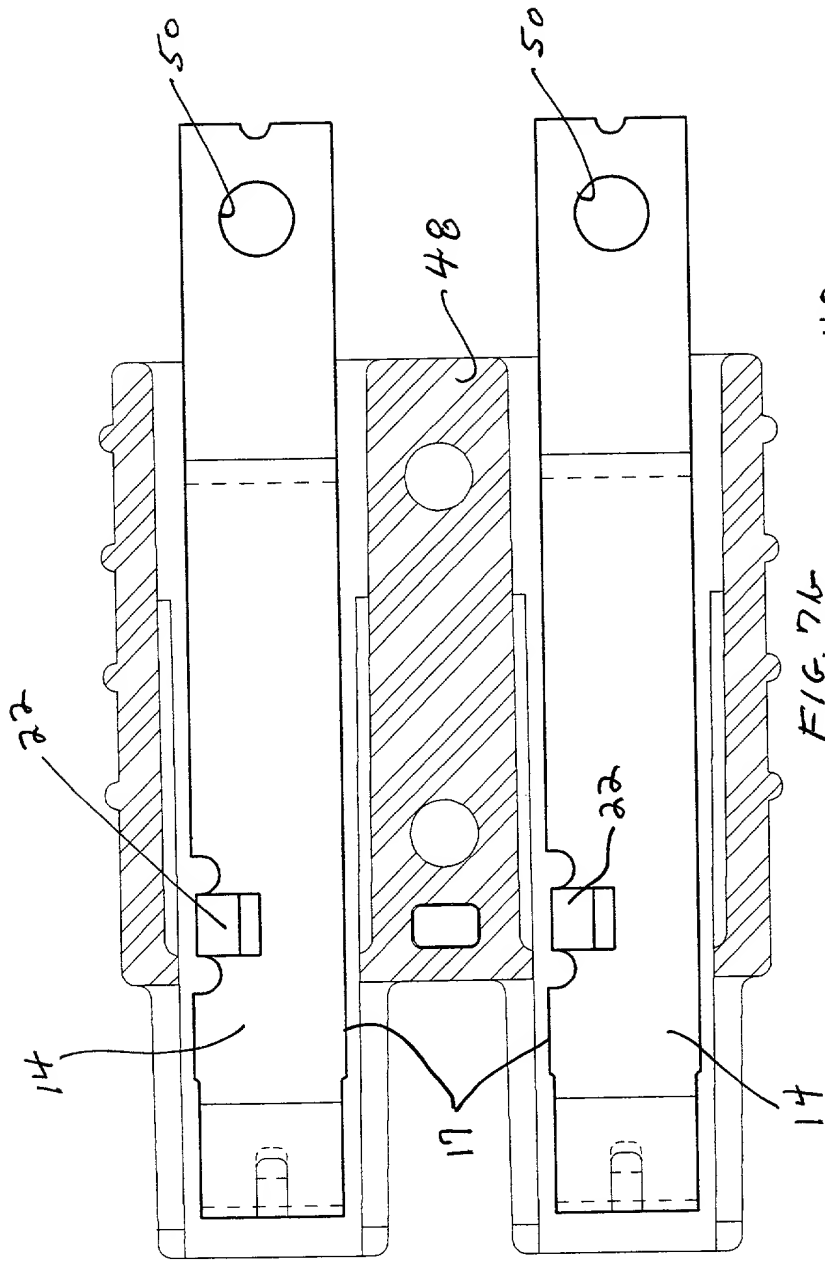


FIG. 6c



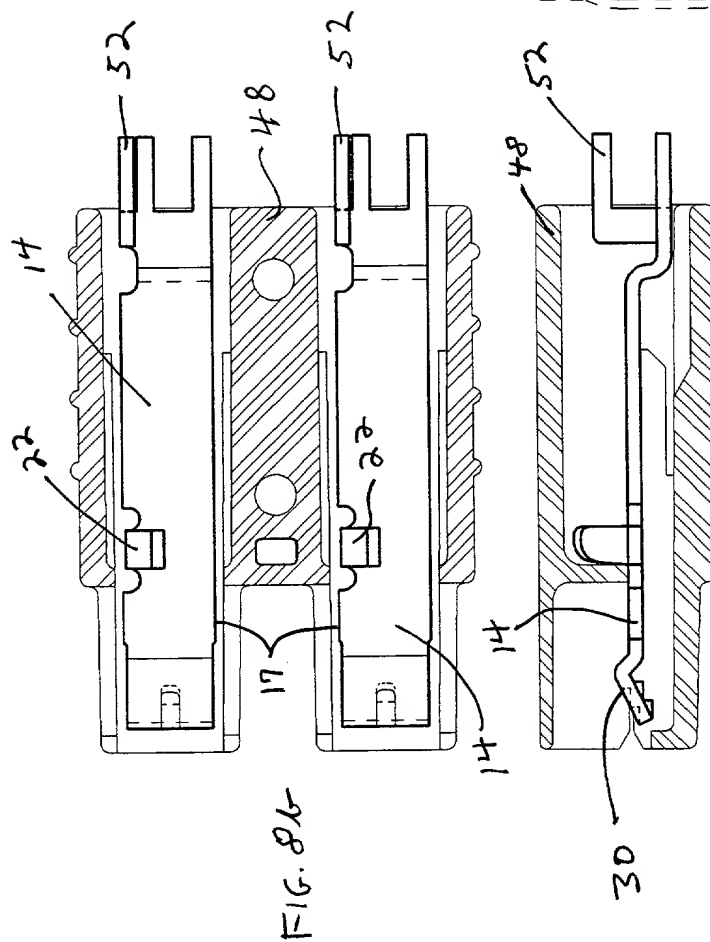


FIG. 8a

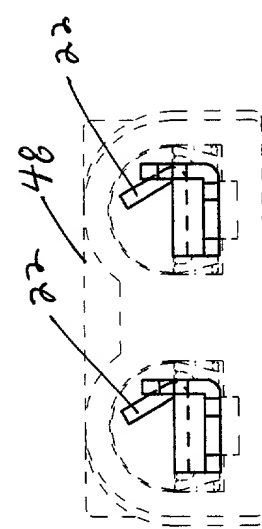


FIG. 8c

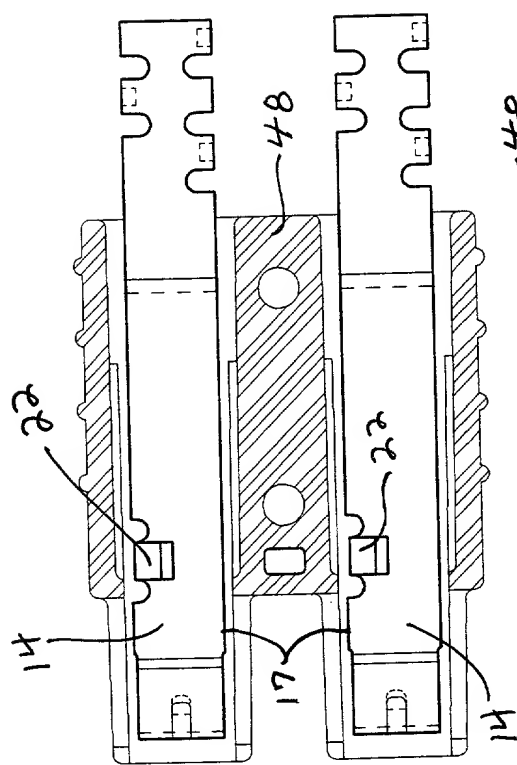


FIG. 9b

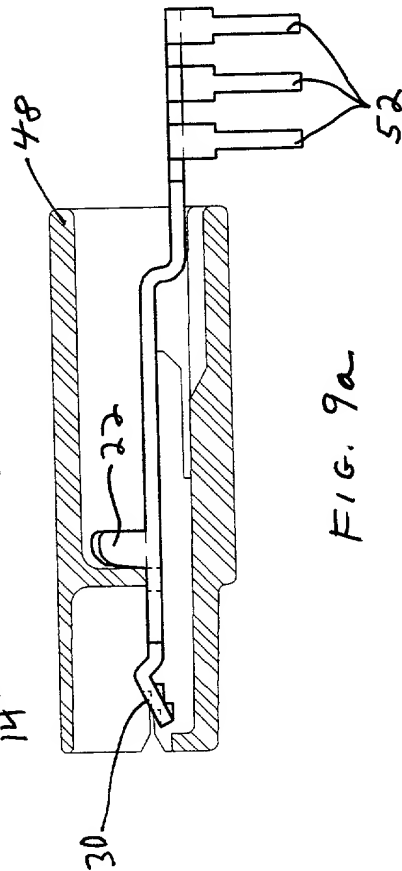


FIG. 9a

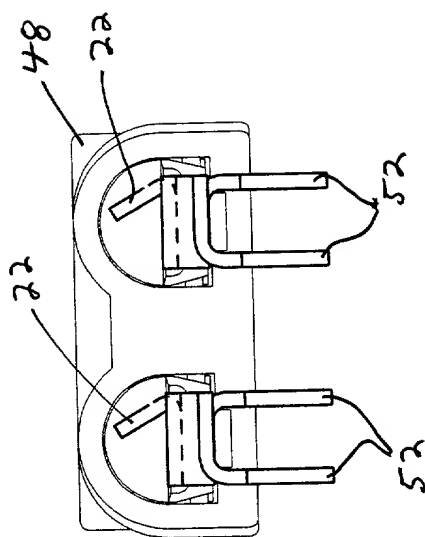


FIG. 9c

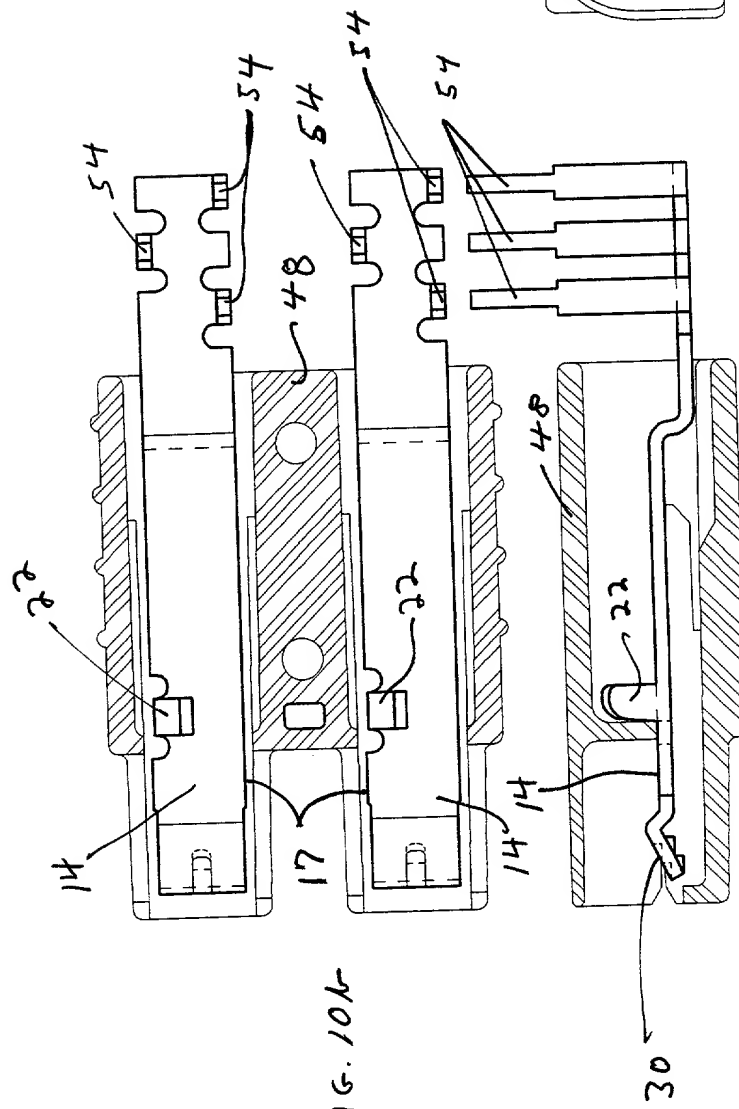


FIG. 10b

FIG. 10a

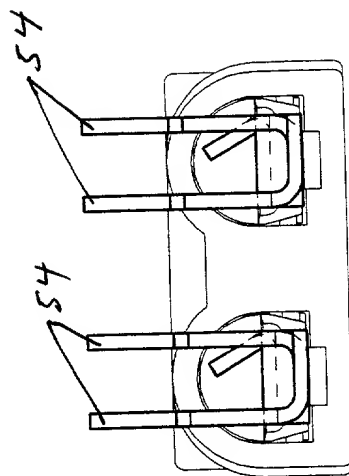


FIG. 10c

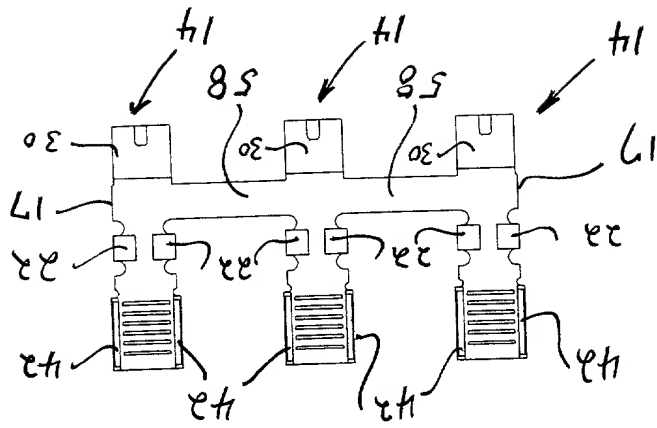


FIG. 11